Social VR: A New Medium for Remote Communication and Collaboration

Jie Li
CWI
Amsterdam, NL
j.li@cwi.nl

Wijnand IJsselsteijn
TU Eindhoven
Eindhoven, NL
W.A.IJsselsteijn@tue.nl

Vinoba Vinayagamoorthy
BBC R&D
London, UK
vinoba.vinayagamoorthy
@bbc.co.uk

David A. Shamma
FX Palo Alto Laboratory
Palo Alto, USA
aymans@acm.org

Raz Schwartz
Facebook, Inc.
California, USA
raz@fb.com

Pablo Cesar
CWI
TU Delft
Amsterdam/Delft, NL
P.S.Cesar@cwi.nl

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Abstract
There is a growing need for effective remote communication, which has many positive societal impacts, such as reducing environmental pollution and travel costs, supporting rich collaboration by remotely connecting talented people. Social Virtual Reality (VR) invites multiple users to join a collaborative virtual environment, which creates new opportunities for remote communication. The goal of social VR is not to completely replicate reality, but to facilitate and extend the existing communication channels of the physical world. Apart from the benefits provided by social VR, privacy concerns and ethical risks are raised when the boundary between the real and the virtual world is blurred. This workshop is intended to spur discussions regarding technology, evaluation protocols, application areas, research ethics and legal regulations for social VR as an emerging immersive remote communication tool.

Author Keywords
Social VR; remote communication; VR ethics; VR evaluation metrics.

CCS Concepts
•Human-centered computing $\rightarrow$ **HCI design and evaluation methods; Virtual reality;** *Collaborative interaction;*

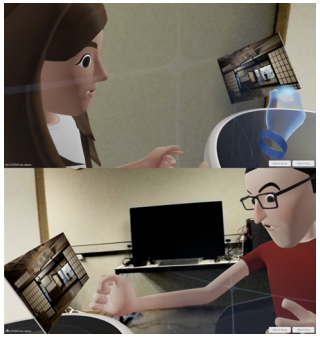

Figure 1: An example of social VR photo sharing activities using Facebook Spaces[a]

Figure 2: An example of real-time capturing and reconstruction of human representations in VR

Figure 3: Cisco Telepresence IX5000 system [8]

[a]https://www.facebook.com/spaces

Introduction

This workshop is intended to raise interdisciplinary discussions on social VR as an emerging immersive remote communication tool. Remote communication allows people who are not physically present in the same location to communicate in real-time. Commercial video conferencing technologies, such as *Skype*[1] and *Google Hangouts* [2], are low-cost and provide immersive experiences compared to audio-only phone calls [6, 11]. The low-cost video conferencing tools perform well in supporting conversation between multiple users, allowing them to see each other's facial expressions and hand gestures, but users do not have adequate information about viewports and physical environments of other remote collaborators [6]. Some high-end video conferencing systems such as *HP Halo* and *Cisco Telepresence* are designed to link two physically separated rooms through wall-size screens, high-fidelity audio and video. So, they resemble co-presence of users in a single conference room, and offer immersive, lifelike experience for engaging remote collaborations [3, 27]. However, they still restrict users in front of screens with "talking heads experiences", and limit physical activities that naturally arise from social interactions and spontaneous collaborations [5, 11].

Virtual Reality (VR) technology is developing at unprecedented speed, which can simulate a user's physical presence in a virtual environment, with less physical restriction than video conferencing systems. Users can look and move around, and interact with virtual objects. VR can be considered as an extension to video conferencing, and as a new medium for supporting remote communication [2]. A social VR system is an application that allows multiple users to join a collaborative virtual environment (VE) and communicate with each other, usually by means of visual-audio cues [7, 12], and multi-sensory feedback [17]. The VE can be a computer-generated 3D scene or a 360° natural scene captured by an omnidirectional camera. Users are represented in the VE as computer-generated avatars [26] or as 2D video representations based on live capture [10]. Microsoft Research demonstrated *Holoportation*, an immersive communication system that can capture people, objects and motions within a room in full 3D, using a set of custom depth cameras. The captured data are virtually teleported into the remote users' space. Each user can see and hear these remote users within their physical space when they wear their Head-Mounted Displays (HMDs)[18].

We posit that social VR is a promising new medium for remote communication, which may better support social presence (e.g., intimacy and immediacy [16]), rich non-verbal communications (e.g., sign languages [29]), and immersive realistic interactions. However, the goal of social VR systems is not to completely replicate reality, but to facilitate and extend existing communication channels of the physical world. Besides, we are aware of the ethical risks of social VR systems. While human representations in VR become increasingly realistic, and research on HMD removal (e.g., [31]) is trying to make user faces visible, privacy concerns are raised (e.g., [19]). This workshop is intended to spur discussions about technology, evaluation protocols, application areas, research ethics and legal regulations for social VR as an immersive remote communication tool.

[1]https://www.skype.com/en/
[2]https://hangouts.google.com

Background

There is a growing need for effective, face-to-face-like remote communication. As Apostolopoulos et al. [3] pointed out, remote communication has many positive societal impacts, such as reducing environmental pollution, travel costs and fatigue, and supporting rich collaboration by con-

necting talented people around the world. Furthermore, remote communication brings families closer together and improves the availability of high quality education and healthcare around the world [3].

VR is a technology with many interaction possibilities: immersing users with 3D images and sound, and encompassing other human senses and perceptive channels. With the shifting focus from isolated experiences to a social medium, social VR has attracted a large stream of research exploring its potential for creating innovative communication approaches, supporting remote experience sharing and collaboration in diverse scientific, artistic, informational and educational domains [9, 22]. McGill et al. [15] examined user preferences regarding social VR for remote media consumption compared to the TV. Despite technical limitations of consumer VR devices (e.g., limited field-of-view), users significantly preferred the embodied social VR telepresence (i.e., the ability to share a space with a remote user) as a means of communicating. Moreover, they also found that consuming traditional TV content in an immersive social VR environment led to significant improvements regarding users' media immersion, engagement, and enjoyment. Social VR is also explored as a new tool for healthcare, including disseminating health information, providing remote (psycho) therapies [1], and training medical professionals [14]. Medical consultations in VR are distinguished from video consultations by their capacity to portray 3D spatial information [28], to exploit users' natural behaviors, and to immerse users in the virtual world. Walia et al. [30] see social VR as a supplemental solution to the nursing shortage and to assist patients with disabilities. Roth et al. [21] designed three visual cues indicating eye contact, joint attention and grouping behavior in a virtual museum, aiming at augmenting the social behavior in VR. They found that these visual cues significantly increase social presence and eye contacts between users. Serafin et al. [24] argued that the design of VR musical instruments should enable social musical experiences, such as allowing the viewers to share the virtual space of the musicians.

Apart from the positive impacts of VR, there are also psychological, moral, and social risks associated with this technology. It is often suggested that VR is ideal for psychological research, because it can be used to recreate dangerous or stressful virtual situations to explore people's reaction, which would be impossible to study in real world [20]. VR also allows exact repetition of experimental conditions [25]. However, some studies have showed that experiences in VR could lead to changes in participants' behavior and attitude in their real life (e.g., [4]). Participants respond to virtual stimulus as if they were real even knowing they are not [25]. Therefore, for conducting research on social VR, or using it as a research tool, it is important to inform participants full information about risks and implications of VR experiences, to make them aware of their right to withdraw the experiments. [13].

Participants and Expected Interests

Social VR has not only attracted attention from academic research, but also from commercial companies, such as Sansar, AltspaceVR, and Facebook Spaces, all of which seek to include social features in their systems [26]. Therefore, we welcome all fields of interest: computer scientists, developers, artists, psychologists, HCI researchers, UX designers, and governmental policymakers etc., to jointly explore social VR as a new medium for remote communication. We expect participants of diverse expertise will have interdisciplinary discussions on social VR topics, resulting in multifaceted new research agenda towards the future of social VR.

Website
The *Home* page of the website displays the goal, important dates of the workshop and a button to submit position paper. The *Call for Participation* page describes the main topics of the workshop. The *Organizers and Contact* pages display the profile photos, contact emails, and personal websites of the organizers. The website is located at https://www.socialvr-ws.com

Pre-Workshop Plans

The workshop is planned to last one day. One keynote talk will be given in the morning to give an overview of the workshop topics. Participants will be asked to give a 2-minute pitch about their work and form interest groups around the topics. The late morning and afternoon will focus on group work and discussion. The workshop organizers will provide the hardware and generative tools to facilitate the group discussion [23]. We plan to distribute a Call for Participation (CFP) to relevant research institutes and universities and on social media. We will also send invitations to potential researchers and practitioners. Submitted position papers will be reviewed and selected by the workshop organizers. Our website will act as portal to advertise the workshop, and to inform and keep contact with the accepted participants.

Workshop Structure

09:00-09:30 Welcome & Introduction: Introduce organizers, participants, workshop objectives, and schedules

09:30-10:00 Keynote: Social VR as a new medium for remote communication & collaboration

10:00-10:15 Coffee Break

10:15-11:15 Pitches: Each participant gives a 3-minute pitch about the position paper

11:15-11:30 Form Groups

11:30-12:30 Group discussion: Participants are guided to use generative tools [23] to present ideas, and deeply dive into the issues arising from the topic discussion.

12:30-13:00 Sandwich Lunch Break

13:00-14:00 Group discussion continues

14:00-14:15 Coffee Break

14:15-14:45 Group Presentation: Each group presents their discussion results in the format of a poster with generated artifacts

14:45-15:00 Discussion & Closing: Organizers lead a wrap-up reflections and potential future collaborations

Call for Participation

Remote communication allows people who are not physically present in the same location to communicate with each other in real-time. This permits us to meet colleagues overseas, work from home to reduce commute cost and live far from our friends and families. Social Virtual Reality (VR) invites multiple users to join a collaborative virtual environment, which creates new opportunities for remote communication. The shared experiences obtained in social VR may reshape our subjective perception towards the physical world, leading to shifts in our understanding about social experience, selfhood, or realness, and bringing about novel everyday social interactions. However, social VR also raises privacy concerns and ethical risks when the boundary between the real and the virtual world is blurred. This workshop is intended to spur discussions on social VR as an emerging immersive remote communication tool.

We invite academics from all fields, e.g., computer science, psychology, HCI/UX, sociology, and designers, developers, practitioners, governmental policymakers to help drive a research agenda for technologies, evaluation protocols, interaction techniques, application areas and research ethics for social VR. In this CHI2020 workshop, we will focus on interactive group work. Participants will be guided to collaboratively discuss the future of social VR using generative tools [23] (e.g., images, clay, texts, 3D models).

Important Dates
Submission Deadline: February 11th, 2020
Notification: February 28th, 2020

This workshop invites submission of position papers: 2-4 pages in SIGCHI Extend Abstract format (reference ex-

cluded) via https://www.socialvr-ws.com, covering (but not limited to) the following topics:

- **Social VR Technologies.** What is the current status of technology (e.g. capturing, reconstruction, rendering)? What are the technological requirements for improving social VR experiences in terms of quality of interaction, privacy protection etc.?
- **Evaluation Protocols for Social VR Experiences.** How to adequately evaluate different aspects of communication in social VR both subjectively (e.g., self-reports) and objectively (e.g., physiological sensors)? How to develop Quality of Experience (QoE) metrics for social VR?
- **Interaction Techniques for Social VR.** Should the interaction techniques replicate the real-world ones through the aid of multi-sensory simulation? Or should the interaction techniques extend beyond the reality?
- **Applications for social VR.** What can be the use cases of social VR? What are the requirements for building such social VR applications?
- **Research Ethics of Social VR.** What are the ethical considerations conducting research on social VR or using it as a research tool? What are the risks that are foreseeable with the widespread use of social VR (e.g., long-term immersion, neglect of the social and physical environment, content, and privacy)?

Submitted position papers will be reviewed and selected by the workshop organizers. At least one author of the accepted paper must attend the workshop. All participants must register for both the workshop and for at least one day of the conference.

Expected Outcomes and Post-Workshop Plan

- Connect a community of researchers, commercial companies and artists interested in social VR technology, evaluation and applications, for initiating new project proposals on social VR topics.
- Collect and analyze the discussions about the proposed topics to provide an overview of benefits, challenges, and risks of using social VR as a new communication tool.
- Collaborate with the organizers and participants to write a position paper about the results of the workshop.

Organizers

Jie Li is a postdoctoral researcher at Distributed Interactive Systems group of The Dutch National Research Institute for Mathematics and Computer Science (CWI). She holds a PhD degree in Human Information communication Design from TU Delft, and is specialised in UX and QoE research. She is currently working on an H2020 project (VRTogehter) to develop subjective metrics for assessing experience in social VR.

Vinoba Vinayagamoorthy is a Project Research and Development Engineer at the BBC. She has research interests in HCI, VR, AR, connected TV, user research, mobile devices, device synchronisation, interaction design and serious games. Her work has appeared in conference and journal publications including ACM SIGCHI, ACM TVX, ACM VRST, Eurographics, IVA, CGF and IEEE TVCG. She has organized workshops, served on program committees and is on the steering committee for ACM TVX.

Raz Schwartz is a research manager on the Facebook AR/VR team. His team focuses on studying social interactions in AR/VR environments by applying qualitative and quantitative methods. Before joining the team, Raz was a

research lead at Oculus and studied social interactions in VR as well as the UX experience of Oculus Quest, Go and Rift. Prior to Facebook, Raz was a postdoctoral researcher at Cornell Tech and at Rutgers University as well as a research fellow at the Brown Institute for Media Innovation at Columbia Journalism School. During his Ph.D., Raz was a visiting scholar at the Human-Computer Interaction Institute at Carnegie Mellon University. Raz's work was published in various academic settings and was featured in media outlets such as the Wall Street Journal, Wired, Rhizome, and The Atlantic.

Wijnand IJsselsteijn is a full professor of Cognition and Affect in Human-Technology Interaction at Eindhoven University of Technology. He has an active research program on the impact of media technology on human psychology, and the use of psychology to improve technology design. His focus is on conceptualizing and measuring human experiences in relation to digital environments (immersive media, serious games, affective computing, personal informatics) in the service of human learning, health, and wellbeing. He has a keen interest in the relation between data science, AI and psychology, and works on technological innovations (such as sensor-enabled mobile technologies, virtual environments) that make possible novel forms of human behavior tracking, combining methodological rigor with ecological validity.

David Ayman Shamma is a senior research scientist at FX Palo Alto Labratory (FXPAL). Prior to FXPAL, he was a principal investigator at Centrum Wiskunde & Informatica (CWI) where he lead a project on Artificial Intelligence (AI), wearables, and fashion. Before CWI, he was the founding director of the HCI Research Group at Yahoo Labs and Flickr. He investigates social computing systems (how people interact, engage, and share media experiences both online and in-the-world) through three avenues: AI, systems & prototypes, and qualitative research; his goal is to create and understand methods for media-mediated communication in small environments and at web scale.

Pablo Cesar leads Distributed and Interactive Systems group at CWI (The Dutch National Research Institute for Mathematics and Computer Science). Pablo's research focuses on modeling and controlling complex collections of media objects (including real-time media and sensor data) that are distributed in time and space. He acted as an invited expert at the European Commission's Future Media Internet Architecture Think Tank and participates in standardization activities at MPEG (point-cloud compression) and ITU (QoE for multi-party tele-meetings).

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